

# CS 4110 Homework 6

## Non-Regular Languages, Decidability

### Chapter 10:

i.  $A_1 = \{ a^n b^{n+1} \}$

$$A_1 = a^p b^{p+1}$$

*If...*

$$XYZ = a^p b^{p+1}$$

$$\text{abs}(XY) \leq p$$

*Then...*

$$X = a^m$$

$$Y = a^{p-m}$$

$$Z = b^{p+1}$$

$XY^2Z$  **not in**  $A_1 \Rightarrow$  Therefore non-regular

ii.  $A_1 = \{ a^n b^n c^n \}$

$$A_1 = a^p b^p c^p$$

*If...*

$$XYZ = a^p b^p c^p$$

$$\text{abs}(XY) \leq p$$

*Then...*

$XY^2Z$  **not in**  $A_1$

iii.  $A_1 = \{ a^n b^{2n} \}$

$$A_1 = \{ a^p b^{2p} \}$$

*If...*

$$W = XYZ$$

$$a^p b^{2p} = XYZ$$

*Then...*

$$X = a^m$$

$$Y = a^n$$

$$Z = a^{p-m-n}b^{2p}$$

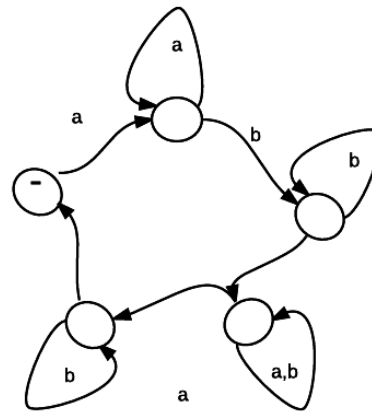
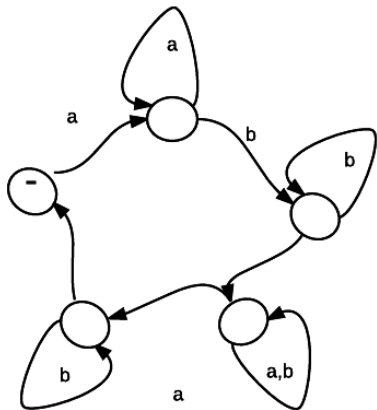
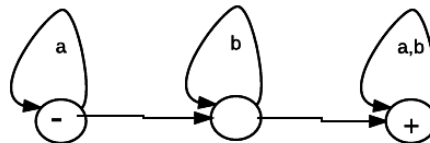
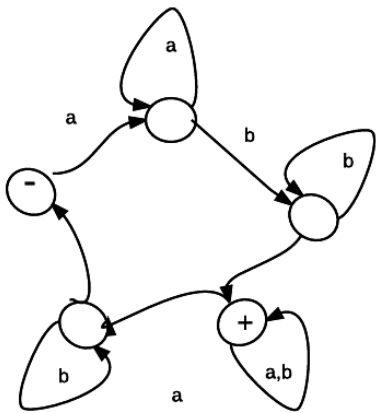
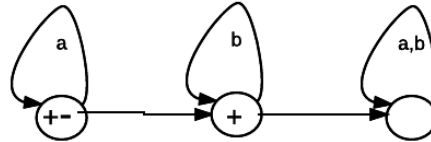
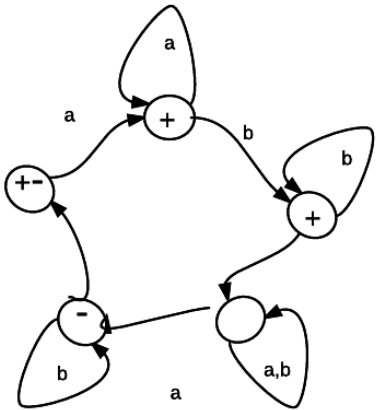
*XZ is in  $A_1$*

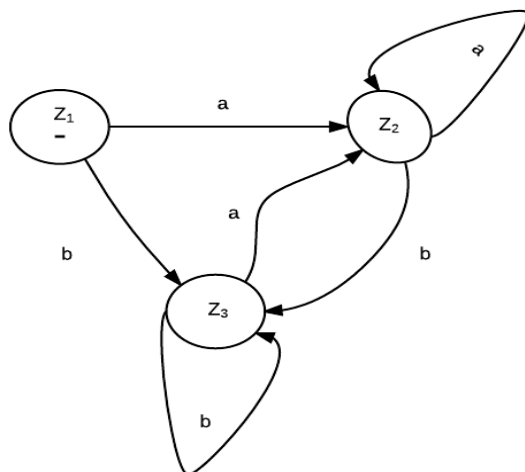
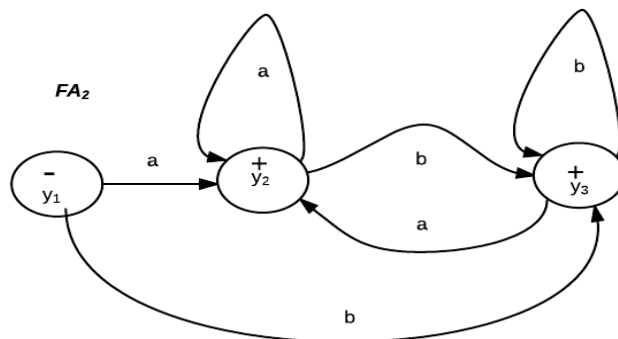
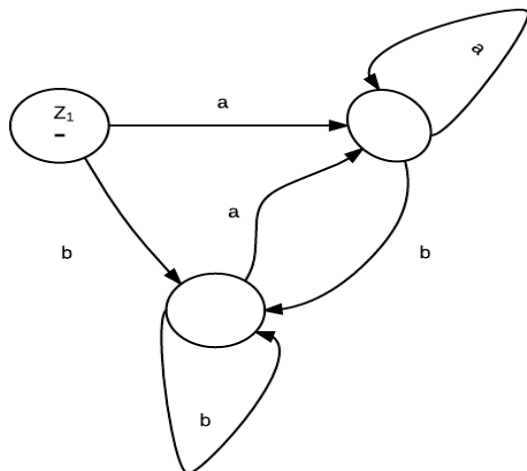
XZ is not in  $a^p b^{2p} \Rightarrow$  Therefore non-regular

6. ☹

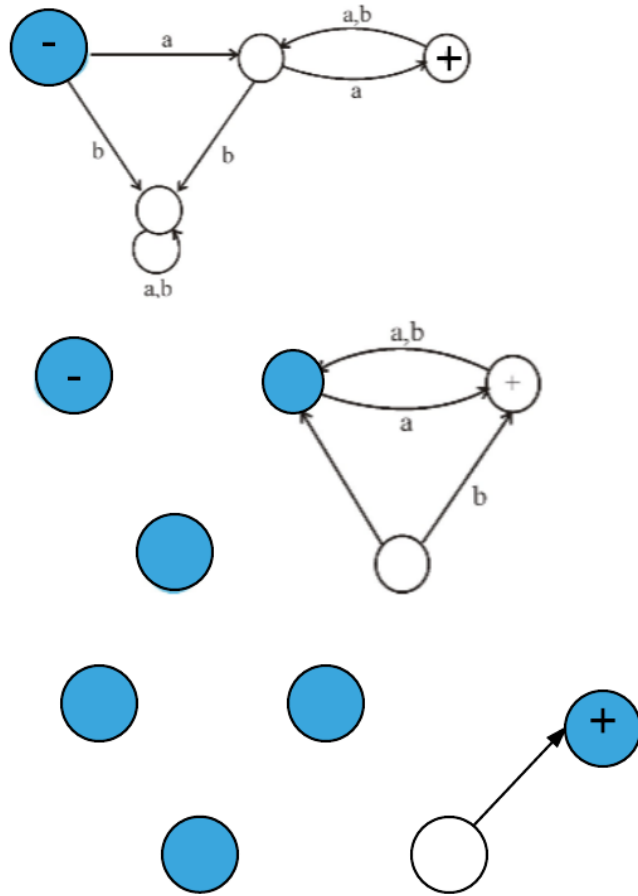
# Chapter 11:

1.  $FA_1$  and  $FA_2$  are equivalent:

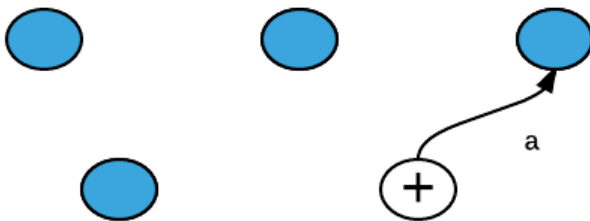
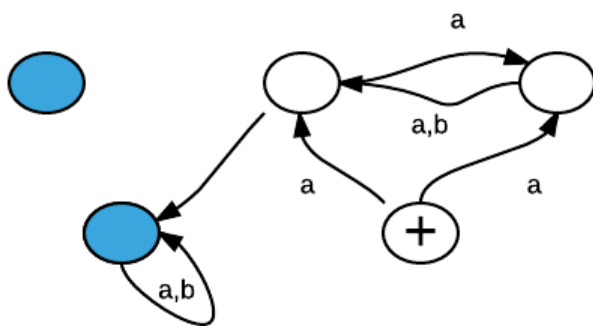
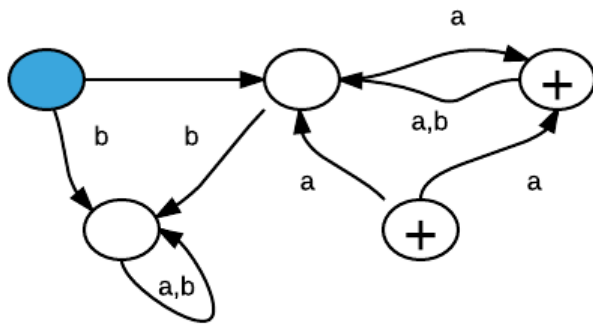




9.



10.



13.

- i.
  - The language generated here only accepts a and ab from the starting to final states.
  - Leftover strings won't make it to the final state
  - Therefore this is a finite language/FA
- iii.
  - This language can make it to the final state, however it can also leave this state and come back.
  - Due to the point above, this allows an infinite number of words to be generated from this FA thus making this an infinite language.

